PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

FOURTH SERIES

VOL. XII, 23, pp. 437–442 AUGUST 21, 1923

XXIII

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921[1]

OBSERVATIONS ON SURFACE DISTRIBUTION OF MARINE DIATOMS OF LOWER CALIFORNIA IN 1921

BY

W. E. ALLEN

Scripps Institution for Biological Research

Nearly all the plankton collections were taken while the boat was in motion and the same methods were used as those which I have described for steamer trips between San Diego and Seattle in 1920 (Allen 1921). Methods of handling the material were also similar. In case of each catch, three gallons of water was dipped from the surface of the sea with a pail and then poured through a filtration net of number 25 bolting silk such as has been used in the past three years for all of our measured water collecting. Hence, when the size of a catch has been estimated in numbers per liter it can properly be compared as to size with any other catch in any of our measured water series.

Most of the plankton samples taken by Dr. Baker were obtained in the Gulf of California, but on the trip to the Gulf, 17 samples were taken in the Pacific Ocean. On account of the necessarily random nature of the sampling it is impossible

[1] A map showing all the islands, etc., visited by this Expedition will be found in Vol. XII, No. 6, of these Proceedings, copies of which can be supplied at nominal cost.

to arrange the material in any sequence of particular significance and I am therefore following the very simple plan of separating the discussion into four sections on the basis of time and of direction of travel.

On account of the very small numbers of dinoflagellates in most catches I am giving them merely incidental mention.

I. Southbound in the Pacific Ocean

Out of the 17 catches made in ocean waters, April 7 to 10, only two showed numbers of cells near to or exceeding 25,000 per liter. The larger of these two catches was made about 25 miles southwest of Abreojos Point and the other about 70 miles northwest of Cape San Lazaro (see map). Four samples between Magdalena Bay and the Gulf of California yielded nothing. Most of the other catches were very small.

The number of species of diatoms recorded was 29, only three of which were sufficiently prominent to deserve special mention. These were *Chætoceras scolopendra* Cl., *Eucampia zoodiacus* Ehr., and *Nitzschia seriata* Cl. Other forms were grouped for tabulation under the names *Chætoceras* sp., *Rhizosolenia* sp., and *Thalassiothrix* sp. The most prominent single species was *Eucampia zoodiacus* Ehr., a form which has not shown much prominence in the La Jolla region so far.

Dinoflagellates were noticed in only seven of the 17 samples and then in very small numbers, mostly fewer than 100 per liter.

II. Northbound in the Gulf of California

On the trip up the Gulf 10 samples were taken in the four days from April 10 to April 13 and 11 were taken in the six days from April 21 to 26. Five of the 10 catches in or near the southern end of the Gulf were blank. Of the 21 samples obtained in the northward run four yielded more than 100,000 diatom cells per liter, a number which indicates a fair degree of productivity. One of these four catches was made near the southern end of Espiritu Santo Island, another about 30 miles east of San Nicolas Bay, a third near Isla Raza and

the fourth about 10 miles southwest from Georges Bay (see map).

Forty-four kinds of diatoms were listed from the catches made on this trip and four species were prominent at one or more of the localities sampled. These were *Bacteriastrum elongatum* Cl., *Chætoceras debile* Cl. (including *Ch. curvisetum* Cl.), *Leptocylindrus danicus* Cl. and *Nitzschia seriata* Cl. *Bacteriastrum elongatum* Cl. has not been noticed in the La Jolla region and its prominence in the Gulf seems to be distinctive. I was also impressed by the appearance of unusual numbers of *Thalassiothrix acuta* Karsten at one place. At various places there were fairly large numbers of unsegregated small species of Chætoceras. Some species of Rhizosolenia were present in nearly all catches.

Dinoflagellates were almost entirely absent from all catches in this group.

III. Southbound in the Gulf

The southward trip covered about six weeks, from April 28 to June 8, samples being taken as the expedition shifted its investigations from one island to another. The 52 catches were fairly well distributed through this time.

Eight catches of diatoms were in excess of 100,000 cells per liter and two of these were near 500,000 per liter. Two of the eight were taken near San Luis Island and four near Angel de la Guardia Island at various points. The other two were obtained near Carmen Island.

Forty-six kinds of diatoms were listed as being present at one or more localities. Eighteen species were included in the final tabulation and most of the others were grouped under *Chætoceras* sp., *Coscinodiscus* sp. and *Rhizosolenia* sp. Of the 18 species segregated there were six, *Chætoceras compressum* Laud., *Chætoceras criophilum* Castr., *Chætoceras debile* Cl. (including *Ch. curvisetum* Cl.), *Chætoceras scolopendra* Cl., *Nitzschia seriata* Cl. and *Thalassiothrix nitzschioides* Grun., which attained numerical prominence at one or more places. In addition to these there were three species which attracted especial attention because they have not been observed in the San Diego region. They were *Bacteriastrum elongatum* Cl.,

Chætoceras neapolitanum Schr., and *Guinardia flaccida* Castr. The large cells of *Guinardia* made it conspicuous even though its numbers were not notably large.

On this trip a few catches were made in which dinoflagellates appeared in some thousands per liter. *Ceratium furca* (Ehr.) Clap.-u. Lach. and *Gonyaulax polyedra* St. were the principal species.

IV. Second Trip Northward in Gulf

This was the last trip made by the expedition and it lasted about four weeks, from June 8 to July 11. Forty-one samples were taken at fairly regular intervals over that time. Of these seven showed diatoms in excess of 100,000 per liter, one near San José Island, two near Carmen Island, two near Angel de la Guardia Island and two near Tiburon Island.

Forty-four kinds of diatoms were recorded, 15 of which were placed in the final tables. Most of the others were included under the designations *Chætoceras* sp. or *Rhizosolenia* sp., or omitted on account of small numbers. Of the 15 species segregated for tabulation there were only three which were found in greater numbers than 30,000 per liter at any time. These were *Chætoceras curvisetum* Cl. (including *Ch. debile* Cl.), *Chætoceras didymum* Ehr. and *Thalassiothrix nitzschioides* Grun. Small forms included under the catchall designation *Chætoceras* sp. furnished far the largest numbers on this northward trip, reaching more than 300,000 per liter in three different catches.

Dinoflagellates were very few or absent from most catches.

General Discussion

Except for its positive evidence as to what could be, and was, found at a given time and place, a series of catches obtained by such discontinuous random sampling can have little more than suggestive value in an attack upon the problems of the ecologic complex. The main points of positive evidence have been stated in the foregoing sections, hence this part of the discussion is chiefly concerned with suggestive features based on this evidence.

In the first place it may be noted that this evidence agrees with that obtained from surface catches between San Diego and Seattle (Allen 1921) in its showing of apparent weakness of influence of latitude in limiting the range of species. So far as we yet know such common species as *Chætoceras debile* Cl. and *Nitzschia seriata* Cl. are just as likely to be amongst the most abundant surface forms at 24° north latitude as they are at 48° north latitude, or at any intermediate point on the Pacific Coast.

In the second place, it seems that we get no very definite indication of the influence of topography although we might expect that conditions in the Gulf would be enough different from oceanic conditions to make at least an appreciable showing. From the informtaion at hand we can get little but the fact that three or four forms not so far observed in our oceanic work are present in the Gulf. This fact is largely offset by the presence of several species in prominence similar to that which we sometimes or often find in the open sea. Large catches being mostly found near islands may possibly be due to the expedition keeping close to islands, but it does have some significance as regards the possible influence of land.

In view of the general recognition of the influence of temperature upon life processes and the activities and characteristics of organisms it is rather surprising to see so little evidence of its effects in this series. Although most of the larger catches were taken in temperatures near 20° C or a little lower, a few were taken in temperatures near 29° C and some of the prominent species in the latter catches were such as have been commonly obtained in our La Jolla region (as well as at some points in the Gulf) in temperatures ranging from 16° C to 20° C. Whatever else we may think about it we may be sure that at present, temperature alone is not a trustworthy index as to either quality or quantity of diatom production in surface waters in various areas.

Concerning the influence of upwelling water there is no satisfactory evidence in this series.

In conclusion we may summarize as follows:

1. There is a striking general similarity in the surface catches of diatoms in Lower California waters to those of much more northerly waters.

2. A few species appearing in more or less prominence in the Gulf of California have not been observed in oceanic waters of the California region.

3. There are marked differences in productivity of various areas in the Gulf, some of which are probably permanent and some of which may be temporary or conditional.

4. There is indication that general production of pelagic dinoflagellates is low in the Gulf region.

5. It seems quite probable that general conditions of plankton production in the Gulf are essentially similar to those in the sea.

6. The Gulf of California offers plenty of opportunity for both extensive and intensive studies of micro-plankton.

7. This series offers another excellent illustration of the fact that the measured water method can be used for valuable studies of micro-plankton under circumstances prohibitive of other methods.